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Research Article

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Soil nutrient status of chilli growing area of Northern Transitional Zone of Karnataka

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Summary

Characterization of surface soil (0-15cm) for fertility status was studied by taking 57 representative samples from chilli growing soils of Northern transitional Zone of Karnataka. The samples were collected from Haveri, Gadag and Dharwad districts. pH was slightly alkaline, EC was non-saline, available nitrogen status was low to medium, available phosphorus was in medium and 100 per cent samples were related to higher available potassium. All the micronutrients were in sufficient status in surveyed fields except iron. Out of 57 samples sixteen samples came under MMM, thirteen samples came under MMH, six samples came under LMH, 11 samples in LMM, two samples came under HMM, MHM and MLH and one sample came under LLH, LLM, LHH, LML, MLM.

Key words : Soil nutrient status, Chilli growing area

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Introduction

Chilli (*Capsicum annuum* L.) is an important spice as well as vegetable crop grown all over India. It is an essential ingredient of Indian curry. The major chilli producing states in India are Andhra Pradesh, Karnataka, Maharashtra, Odisha, Rajasthan and Tamil Nadu. These states contribute to around 86 per cent to total area under chilli and 90 per cent to the total Indian produce. The important chilli growing districts in Karnataka are Haveri, Gadag, Dharwad, Koppal, Belgaum, Bellary and Raichur of which Haveri and Dharwad districts make-up 72 and 60 per cent of total area and production, respectively (Anonymous, 2009). In 2009-2010, the area under chilli crop was 762.2 thousand ha, production was 1202.9 thousand tones and productivity was 1568 kg ha^{-1} in India. In Karnataka, the area under chilli was 1, 09,185 ha, with a production of 1, 05,401 tones and productivity of 1016 kg ha^{-1}. The productivity of chilli is affected by many factor, one of them is soil nutrients, the imbalance of which constraint the productivity. In the present study an effort was made to determine the soil chemical properties and their fertility status in the Northern transitional Zone of Karnataka that would focus on adapting appropriate cultivation and nutritional management practices to keep the crop healthy and productive.

Resource and Research Methods

A survey was conducted in the months of May-June 2011 in predominantly chilli growing area in Northern Transitional Zone of Karnataka and collected 57 surface soil samples across major agro-ecological situations of

the zone. Soil samples were collected in Gadag, Dharwad, Gadag and Haveri district. A total of 27, 13 and 18 soil samples were collected from Dharwad, Gadag and Haveri districts, respectively. The geographical locations of sampling fields were noted by using GPS meter (Garmin make, etrex Vista-H model). Collected samples were pre-processed by shade drying for 5 days, pounded and sieved through 2 mm sieve. Soil samples were categorized into low, medium and high status of available N, P and K (Prakash *et al.*, 2007). The range, mean and standard error were calculated to interprete of data and presented Table 1. The samples were analyzed for pH (1:2.5 soil water suspension), electrical conductivity (1:2.5 soil water suspension), organic carbon (wet oxidation), available nitrogen (alkaline permanganate), available phosphorus (0.5 N $NaHCO_3$ extraction), available potassium (neutral normal NH_4O Ac extraction) and available micronutrients (DTPA+ $CaCl_2$+TEA extraction). Based on the available N, P_2O_5 and K_2O, the soils were categorized into low, medium and high fertility status.

Research Findings and Discussion

Surveyed soil samples having maximum soil pH was 9.52 and the minimum was 6.12 (Table 1). The average was 8.15. Seven per cent of the soil samples were slightly acidic in nature. One-fifth (22%) of the samples were neutral in reaction. Most of the samples (71%) recorded slightly alkaline pH. Being predominantly calcareous, it was logical that pH of these soils was slightly alkaline. The chilli growing soils $EC_{(1:2.5)}$ ranged from 0.09 to 1.43 dS m^{-1}. The average EC was 0.37 dS m^{-1} it means that these soils are non-saline in nature. Prevailing climate with sufficient rainfall (mean annual rainfall around 967.9 mm) favoured leaching of salts from the soil profile, therefore, chilli growing soils were non saline. Chilli being susceptible to moderate soil salinity, the crop is preferably grown in non-saline fields. Similar observations of slightly alkaline pH and non-saline nature of soils had also been reported by Shiparamatti (1981).

Soil organic carbon status remained low to medium. The chilli growing farmers of the region have practice of low organic manure application. This is due to non-sufficient availability of organic manures. Gaddi (1999) had reported that soils in zone VIII were low in organic carbon similar to present experimental results.

Among the surveyed samples, nitrogen ranged from 112 to 672 kg ha^{-1} and the average remained 221kg ha^{-1}. Most of the surveyed soil samples had low available nitrogen content (out of 57 sample 49 % of samples were low in nitrogen status). Forty seven per cent of the samples were medium and only 4 per cent had high available nitrogen status in soil. Available soil phosphorus (P_2O_5) in chilli growing areas was as low as 15.6 kg ha^{-1}. The highest available P_2O_5 was 68.0 kg ha^{-1}. The average available phosphorus was 32.6 kg ha^{-1}. Available soil phosphorus (P_2O_5) in chilli growing areas was low in 8 per cent of the soils. Medium status of available P_2O_5 was observed in 85 per cent of samples. As low as seven per cent of the samples had high status of available phosphorus. Available potassium of soils ranged from 168 to 576 kg ha^{-1} and average value was 332 kg ha^{-1}. Sixty per cent of the samples were high in potassium content and 40 per cent were medium in available potassium. None of the samples had low status of potassium, and represented the category of 'LMH'. The poor status of soil organic carbon resulted in low status of available nitrogen. Pradeep (2004) reported that deep black soil of Zone-VIII were low in available nitrogen. The chilli growing farmers of Zone-VIII had tendency to use higher phosphatic fertilizers (especially di-ammonium phosphate). Use of phosphatic fertilizers over the years had resulted in build-up of soil phosphorus (as indicated by fertilizer usage data collected during sampling). Deep and medium deep black soils of Zone-VIII were suitable for chilli and these soils are classified as vertisols under US taxonomical classification. These soils are predominated by montmorillonite clays. Montmorillonite clay being potassium rich, the available status of K was rated as high in these soils.

The micronutrient (Cu, Zn, Fe and Mn) status of soils revealed that the soil samples were analyzed to be sufficient, respectively indicating sufficiency of these two nutrients in majority of soil (Table 2). Similar results were reported by Pradeep (2004).

Available zinc content in the surveyed soil sample ranged from 0.19 to 0.80 mg kg^{-1}. The average was 0.44 mg kg^{-1}. Among the analysed samples, 70 per cent of samples were sufficient in available zinc. The average available copper content was 0.51mg kg^{-1}. Among the samples, 97 per cent were sufficient in available copper content. Only 3 per cent of the samples were found to be deficient. Only fifteen per cent of the samples had sufficient status of available iron. On the other hand, 85 per cent of the samples were low in available iron. . The average remained 3.48 mg kg^{-1}. Manganese content in

Table 1 : Soil chemical properties and nutrient status in chilli growing areas

Sr. No.	Latitude (N)	Longitude (E)	pH (1:2.5)	EC (1:2.5) dS m^{-1}	OC (g $kg^{-1}$of soil)	Available major nutrient (kg ha^{-1})			Fertility status
						N	P_2O_5	K_2O	
Gadag district									
1.	$15^0$22' 17"	75^0 23' 11.7"	8.94	0.18	3.76	233	41.7	336	LMH
2.	15^0 21' 9.6"	$75^0$24' 18.9"	7.76	0.28	4.72	368	23.8	480	MMH
3.	$15^0$21' 1.1"	$75^0$24 ' 41.6"	9.26	0.22	4.76	392	33.9	336	MMH
4.	15^0 19' 58.2"	$75^0$25 ' 34"	9.26	0.6	3.68	216	23.8	396	LMH
5.	15^0 19' 24.5"	$75^0$25 ' 56.3"	8.37	0.14	4.16	330	38.5	456	MMH
6.	15^0 19' 8.6"	$75^0$26' 15.5"	8.90	0.39	8.08	416	41.2	396	MMH
7.	15^0 18' 5.4"	$75^0$27' 5.6"	6.82	0.42	3.84	246	22.9	432	LMH
8.	15^0 17' 53.5"	$75^0$27' 31.7"	7.36	0.56	4.04	251	16.5	396	LLH
9.	15^0 17' 4.5"	$75^0$30' 12.4"	8.10	0.36	4.48	392	16.5	384	MMH
10.	15^0 16' 8.6"	$75^0$31' 46.6"	7.42	0.15	3.92	268	19.1	456	MLH
11.	15^0 13' 23.3"	$75^0$34' 42.5"	8.87	0.54	3.92	268	15.6	384	MLH
12.	15^0 12' 49.9"	$75^0$34' 44.4"	8.11	0.19	7.84	392	30.2	480	MMH
13.	15^0 12' 18.2"	$75^0$34' 48.9"	8.24	0.46	4.64	291	25.6	180	MMM
14.	15^0 11' 40.6"	$75^0$34' 50"	8.58	0.21	4.08	244	30.2	276	LMM
15.	15^0 10' 58.6"	75^0 35' 27.9"	7.85	0.33	3.76	258	54.0	396	LHH
16.	15^0 12' 6.9"	75^0 30' 8"	8.88	0.61	4.68	302	41.2	276	MMM
17.	15^0 11' 5"	75^0 29' 51.5"	9.28	0.43	3.44	214	33.9	348	LMH
18.	15^0 9' 16.8"	75^0 32' 14.5"	6.95	0.56	4.44	288	30.2	468	MMH
19.	15^0 7' 18.66"	75^0 28'48.93"	7.68	0.35	4.00	280	39.4	300	MMM
20.	14^0 57' 29.91"	$75^0$19' 42.93"	6.45	0.26	4.00	280	38.5	204	MMM
21.	14^0 58' 12.69"	75^0 23'52.11"	6.21	0.09	3.52	216	24.7	252	LMM
22.	14^0 39' 39.82"	75^0 28'33.27"	8.51	0.68	4.68	314	37.6	337	MMM
23.	14^0 39' 14.67"	75^0 28'36.21"	8.12	0.56	4.16	297	18.3	264	MLM
24.	14^0 39' 18.94"	75^0 27'21.79"	7.23	0.43	4.16	297	29.8	348	MMH
25.	14^0 42' 47.92"	75^0 28' 55.05"	8.90	0.23	3.36	209	38.5	336	LMH
26.	14^0 42' 13.13"	75^0 29' 12.13"	8.78	0.18	4.84	316	33.9	492	MMH
27.	14^0 42' 7.5"	75^0 29' 14.7"	8.40	0.33	5.68	310	43.1	276	MMM
Dharwad district									
28.	14^0 41' 21.38"	74^0 29' 25.2"	8.70	0.39	3.96	242	36.6	324	LMM
29.	$14^0$37' 49.1"	75^0 28' 35.8"	6.73	0.65	5.11	280	68.0	276	LHM
30.	14^0 39' 35.4'	75^0 28' 17.3"	7.32	0.39	5.44	284	23.8	576	MMH
31.	$14^0$38' 56.1"	75^0 27 ' 54.9"	7.21	0.33	5.44	284	28.4	312	MMM
32.	14^0 38' 47.5"	$75^0$27' 22.6"	7.31	0.14	5.64	310	30.2	312	MMM
33.	14^0 37' 21.8"	$75^0$25' 50"	6.12	0.09	4.24	267	23.8	300	MMM
34.	14^0 36' 6.9"	$75^0$23' 52.8"	6.86	0.15	5.06	278	33.9	300	MMM
35.	14^0 36' 8.6"	75^0 23' 49.9"	7.83	0.22	4.24	267	36.6	504	MMH
36.	14^0 36' 5.8"	75^0 23' 50.2"	7.46	0.41	4.68	271	60.9	324	MHM
37.	$14^0$50' 1.5"	75^0 23' 29.8"	6.50	0.16	5.20	322	32.1	396	MMH
38.	$14^0$35' 53.1"	75^0 22' 22"	7.99	0.16	5.10	314	28.4	312	MMM
39.	14^0 38' 14.6"	$75^0$22' 39.2"	8.12	0.55	5.58	304	25.6	264	MMM
40.	$15^0$50' 55.9"	75^0 19' 50"	8.43	0.88	5.94	309	32.1	300	MMM

Table 1 : Contd.……

Table 1 : Contd……

Haveri district									
41.	15^0 43’ 4.88”	74^0 92’ 50.6”	7.35	0.75	8.84	616	33.9	276	HMM
42.	14^0 98’ 36.5”	75^0 27’ 0.88”	9.52	0.11	5.04	316	41.7	312	MMM
43.	14^0 98’ 1.94”	75^0 27’ 61.6”	9.06	0.61	4.64	268	29.3	300	MMM
44.	14^0 98’ 2.61”	75^0 29’13.6”	8.81	0.35	4.12	254	18.3	288	LLM
45.	14^0 98’ 39.5”	75^0 30’ 28.8”	8.76	0.32	4.64	268	37.6	264	LMM
46.	14^0 98’ 47.2”	75^0 32’ 10.3”	7.67	0.16	5.88	280	30.2	307	MMM
47.	15^0 50’ 78”	75^0 41’ 30.7”	8.46	0.46	8.60	368	36.6	348	MMH
48.	15^0 5’ 97”	75^0 41’ 3.88”	8.65	0.56	4.20	240	28.4	324	LMM
49.	14^0 96’ 96.2”	75^0 52’ 51.9”	8.70	0.21	4.00	228	25.6	276	LMM
50.	14^0 96’ 67”	75^0 32’ 29.2”	9.44	0.26	5.04	274	59.5	168	MHM
51.	14^0 96’ 58.4”	75^0 31’ 68.4”	9.13	0.17	8.44	616	33.0	264	HMM
52.	14^0 96’ 53.9”	75^0 31’60.3”	8.65	0.16	4.40	232	36.6	300	LMM
53.	14^0 96’ 48.2”	75^0 30’ 49.1”	8.71	0.27	3.80	212	32.1	228	LMM
54.	14^0 95’ 98.7”	75^0 29’ 10.3”	8.7	0.22	4.00	228	29.8	312	LMM
55.	14^0 25’ 3”	75^0 27’ 68.3”	8.76	0.25	3.60	204	24.3	168	LML
56.	14^0 94’ 33.6”	75^0 29’ 27.3”	9.27	0.42	3.20	196	34.8	336	LMH
57.	14^0 94’ 13.9”	75^0 26’ 90.4”	9.13	0.36	5.20	224	24.7	288	LMM
	Max.	-	9.52	1.43	9.00	672	68.0	576.	-
	Min.	-	6.12	0.09	3.20	112	15.6	168.	-
	Average	-	8.15	0.37	4.78	221	32.6	332	-
	S.E.±	-	0.12	0.03	0.19	18	1.4	11	-
	Low / acidic	-	4 (8.0%)	-	35 (61%)	28 (49%)	5 (8%)	0	-
	Medium/ neutral	-	13 (22%)	-	18 (31%)	24 (47%)	48 (85%)	23 (40%)	-
	High /alkaline	-	40 (70%)	-	4 (8%)	2 (4%)	4 (7%)	34 (60%)	

Table 2: Micronutrient status in chilli growing areas

Sr. No.	Latitude (N)	Longitude (E)	Available micronutrients (mg kg^{-1})			
			Zn	Cu	Fe	Mn
Gadag district						
1.	15^0 22’ 17”	75^0 23’ 11.7”	0.44	0.37	3.26	5.58
2.	15^0 21’ 9.6”	75^0 24 ‘ 18.9”	0.76	0.16	3.30	7.02
3.	15^0 21’ 1.1”	75^0 24 ’ 41.6”	0.37	0.60	4.17	7.14
4.	15^0 19’ 58.2”	75^0 25 ‘ 34”	0.27	0.46	4.31	7.38
5.	15^0 19’ 24.5”	75^0 25 ’ 56.3”	0.19	0.52	1.09	5.82
6.	15^0 19’ 8.6”	75^0 26’ 15.5”	0.58	0.65	3.89	17.38
7.	15^0 18’ 5.4”	75^0 27’ 5.6”	0.42	0.51	1.29	7.56
8.	15^0 17’ 53.5”	75^0 27’ 31.7”	0.49	0.43	4.06	6.96
9.	15^0 17’ 4.5”	75^0 30’ 12.4”	0.29	0.42	3.61	6.18
10.	15^0 16’ 8.6”	75^0 31’ 46.6”	0.66	0.75	5.98	6.48
11.	15^0 13’ 23.3”	75^0 34’ 42.5”	0.31	0.39	1.32	6.18
12.	15^0 12’ 49.9”	75^0 34’ 44.4”	0.39	0.49	1.74	6.42
13.	15^0 12’ 18.2”	75^0 34’ 48.9”	0.32	0.52	1.69	6.42
14.	15^0 11’ 40.6”	75^0 34’ 50”	0.31	0.41	3.64	6.24
15.	15^0 10’ 58.6”	75^0 35’ 27.9”	0.32	0.57	5.27	6.42
16.	15^0 12’ 6.9”	75^0 30’ 8”	0.39	0.46	3.61	6.18

Table 2 : Contd……..

Table 2 : Contd……..

17.	15^0 11’ 5”	75^0 29’ 51.5”	0.26	0.53	3.54	6.06
18.	15^0 9’ 16.8”	75^0 32’ 14.5”	0.31	0.37	6.00	15.76
19.	15^0 7’ 18.66”	75^0 28 48.93”	0.54	0.57	1.26	6.78
20.	14^0 57’ 29.91”	75^0 19’ 42.93”	0.28	0.46	3.99	6.84
21.	14^0 58’ 12.69”	75^0 23’ 52.11”	0.53	0.49	2.91	5.82
22.	14^0 39’ 39.82”	75^0 28’ 33.27”	0.77	0.90	3.71	6.36
23.	14^0 39’ 14.67”	75^0 28’ 36.21”	0.29	0.65	2.88	5.76
24.	14^0 39’ 18.94”	75^0 27’ 21.79”	0.50	0.71	2.43	5.64
25.	14^0 42’ 47.92”	75^0 28’ 55.05”	0.29	0.37	3.89	6.66
26.	14^0 42’ 13.13”	75^0 29’ 12.13”	0.65	0.49	1.36	5.88
27.	14^0 42’ 7.5”	75^0 29’ 14.7”	0.55	0.37	1.30	5.46
Dharwad district						
28.	14^0 41’ 21.38”	74^0 29’ 25.2”	0.36	0.46	3.92	6.72
29.	14^0 37’ 49.1”	75^0 28’ 35.8”	0.67	0.62	5.70	13.38
30.	14^0 39’ 35.4’	75^0 28’ 17.3”	0.31	0.94	3.30	6.12
31.	14^0 38’ 56.1”	75^0 27 ’ 54.9”	0.26	0.84	6.01	5.22
32.	14^0 38’ 47.5”	75^0 27’ 22.6”	0.44	0.58	4.47	6.96
33.	14^0 37’ 21.8”	75^0 25’ 50”	0.66	0.10	6.57	13.14
34.	14^0 36’ 6.9”	75^0 23’ 52.8”	0.25	0.43	7.59	5.04
35.	14^0 36’ 8.6”	75^0 23’ 49.9”	0.73	0.61	3.65	7.26
36.	14^0 36’ 5.8”	75^0 23’ 50.2”	0.32	0.54	2.80	6.48
37.	14^0 50’ 1.5”	75^0 23’ 29.8”	0.24	0.44	2.43	4.86
38.	14^0 35’ 53.1”	75^0 22’ 22”	0.51	0.40	2.46	7.32
39.	14^0 38’ 14.6”	75^0 22’ 39.2”	0.64	0.56	2.20	12.78
40.	15^0 50’ 55.9”	75^0 19’ 50”	0.80	0.60	3.92	6.72
Haveri district						
41.	15^0 43’ 4.88”	74^0 92’ 50.6”	0.59	0.41	3.62	5.10
42.	14^0 98’ 36.5”	75^0 27’ 0.88”	0.44	0.56	4.41	7.56
43.	14^0 98’ 1.94”	75^0 27’ 61.6”	0.50	0.32	4.28	7.84
44.	14^0 98’ 2.61”	75^0 29’ 13.6”	0.31	0.34	4.45	11.14
45.	14^0 98’ 39.5”	75^0 30’ 28.8”	0.53	0.37	3.29	5.64
46.	14^0 98’ 47.2”	75^0 32’ 10.3”	0.59	0.37	3.20	7.08
47.	15^0 50’ 78”	75^0 41’ 30.7”	0.49	0.41	1.28	7.14
48.	15^0 5’ 97”	75^0 41’ 3.88”	0.35	0.47	1.07	5.52
49.	14^0 96’ 96.2”	75^0 52’ 51.9”	0.23	0.34	3.64	6.24
50.	14^0 96’ 67”	75^0 32’ 29.2”	0.43	0.45	7.07	12.12
51.	14^0 96’ 58.4”	75^0 31’ 68.4”	0.52	0.48	3.36	5.76
52.	14^0 96’ 53.9”	75^0 31’ 60.3”	0.30	0.51	1.12	6.06
53.	14^0 96’ 48.2”	75^0 30’ 49.1”	0.46	0.56	3.92	6.72
54.	14^0 95’ 98.7”	75^0 29’ 10.3”	0.32	0.49	1.01	5.88
55.	14^0 25’ 3”	75^0 27’ 68.3”	0.33	0.49	3.43	5.88
56.	14^0 94’ 33.6”	75^0 29’ 27.3”	0.48	0.98	6.86	11.76
57.	14^0 94’ 13.9”	75^0 26’ 90.4”	0.71	0.58	1.84	6.96
	Max.		0.80	0.98	7.59	17.38
	Min.		0.19	0.10	1.01	4.86
	Average		0.44	0.51	3.48	7.35
	S.E. ±		0.021	0.021	0.022	0.35
	Deficient		17 (30%)	2 (3%)	48 (84%)	0
	Sufficient		40 (70%)	55 (97%)	9 (15%)	57 (100%)

the surveyed soil samples ranged from 4.86 to 17.38 mg kg^{-1} and the average was 7.35 mg kg^{-1}. All the samples had enough available manganese (100 % samples were sufficient).

Conclusion :

Chilli growing soils of Northern Transition Zone of Karnataka, the pH was slightly alkaline, EC was non-saline, available organic carbon content was low in most of the soils. Nitrogen was the most deficient followed by phosphorus and medium to high status potassium content. And all the micronutrients were sufficient status in surveyed fields except iron.

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